Claim 15. (Amended) The ink-jet recording sheet according to claim 1, wherein the ink-receptive layer contains a hydrophilic binder and a cross-linking agent of the hydrophilic binder.

Claim 16. (Amended) The ink-jet recording sheet according to claim 15, wherein the cross-linking agent is boric acid or a borate.

REMARKS

Reconsideration and allowance of the subject application are respectfully requested.

The applicants' undersigned patent counsel wishes to express his appreciation to Examiners Nguyen and Kelly for the courtesy extended during the interview of June 12, 2002. It is sincerely believed that the interview materially advanced prosecution of this application. The submission of this Amendment is believed to be commensurate with the discussions during the interview.

The specification has been amended at page 1 as shown above to correct an obvious typographical error. The specification has been amended at page 5 as shown above as supported by the context of the specification, for example at page 4, lines 30-31 and lines 34-35, and at page 5, line 1.

Claims 1, 2, 4, 7, 8, 9, 10, 11, 12, 14 15 and 16 have been amended as shown above to replace the term "printing" with the term "recording" in order to

correct a typographical error. This correction is supported in the specification, for example at page 4, lines 30-31 and lines 34-35, and at page 5, line 1.

Additionally, claim 1 has been amended by essentially incorporating the subject matter of claim 6 and as supported in the specification, including at page 8, lines 12-17. Claim 6 has been accordingly cancelled. Claim 1 has also been amended by replacing "synthetic silica" with "fumed silica" as supported in the specification, including at page 2, line 4, at page 5, line 27 and at page 6, lines 5-14.

The term "prepared by a gas phase process" has been deleted from claims 1 and 7 as supported in the specification, including at page 7, liens 13-15.

No new matter has been added.

Claim 1 stands rejected under 35 USC 112, second paragraph because the Examiner does not understand the reason for including the phase "prepared by a gas phase process" in claim 1. Claim 1 and dependent claim 7 have accordingly been amended as shown above to delete this phase.

In the amendment to claim 1, the term "fumed silica" is a general expression of synthetic silica prepared by a gas phase process. As evidence supporting this fact, the applicants submit copies of U.S. Patents No. 5,116,535 and No. 5,246,624 as technical support documents, attached hereto. Please refer to these documents. In particular, at column 1, lines 27-30 of USP 5,246,624, a general preparation method of fumed silica has been disclosed, which method is the same as that described on page 6, lines 5-15 of the present specification. Thus, the term "fumed silica" is a general expression of synthetic silica prepared by a gas phase process.

The applicants submit that all presently considered claims are fully allowable under Section 112, second paragraph.

The applicants respectfully traverse the rejection of claims 1-2, 4, 6-12 and 14 under 35 USC 103(a) over Ali et al., in view of Santo et al.

The applicants respectfully traverse the rejection of claims 1 and 10-12 under 35 USC 103(a) over Ali et al., in view of Santo et al.

The applicants respectfully traverse the rejection of claims 1 and 15-16 under 35 USC 103(a) over Ali et al., in view of Kasahara et al.

None of the cited references taken alone or in combination, make the presently claimed invention to be obvious.

As background, please be aware that an ink-receptive layer of an ink-jet recording material can be roughly classified into two types, one of which is a porous ink-receptive layer comprising a pigment such as silica fine particles and a hydrophilic binder such as polyvinyl alcohol as intended by the present invention, and the other is an ink-receptive layer comprising a liquid-absorbing polymer as described in the cited reference of Ali et al. In the former type, ink is absorbed in the voids between the pigments, while in the latter type, the polymer itself absorbs ink. Thus, the underlying technology of the present invention and that of Ali are quite different from each other, and the applicants do not believe that a person of ordinary skill in the art would refer to Ali et al. when considering the presently claimed invention. Additionally, the applicants point out that the presently claimed invention clearly distinguishes from the teachings of Ali for reasons including the following.

In the ink-receptive layer of the presently claimed invention, it is necessary to make many voids in the ink-receptive layer to heighten both of the

ink-absorption amount and an ink-absorption rate. To make many voids, it is necessary (1) to use a large amount of the pigment and (2) to use the hydrophilic binder with a smaller ratio or amount relative to the pigment (i.e., a ratio of the hydrophilic binder in the ink-receptive layer will be small because the hydrophilic binder clogs the voids). In the ink-receptive layer of the present invention, there is fumed silica present in an amount of 8 g/m^2 or more and a ratio of the hydrophilic binder to the fumed silica of 50% by weight or less.

In contrast, Ali discloses that the polymer itself absorbs ink. Accordingly, it is not necessary to make voids in the ink-receptive layer of Ali and a pigment is not present in such an amount that they form voids.

Ali discloses that particulate materials having a diameter of 5 to 40 μm such as polymeric beads and silica are contained in the ink-receptive layer. That is, in the type of ink absorption by the polymer as disclosed in Ali, it is necessary to control the adhesive property of the ink-receptive layer or to prevent it from causing damage (e.g., scratches), so that a particulate material having a large size (a particulate material having a particulate size of 5 to 40 μm, preferably at least 50% of the particulate material has a diameter of 20 to 40 μm as described at column 19, line 59 to column 20, line 6 of the Ali reference) is present, a part of which is projected from the surface of the ink-receptive layer.

An amount of the particulate material in Ali is restricted to an amount which gives a haze level of 15% or less (see column 19, line 66 of the reference). When an amount of the particulate material becomes large, the haze level also becomes high which lowers transparency. Thus, in Ali, the amount of the particulate material is limited to as little as possible, so as to

avoid losing transparency. Accordingly, no voids are present in the ink-receptive layer of Ali.

As described above, the constitution of the ink-receptive layer of the presently claimed invention and that of Ali are basically and significantly different from each other and the properties are also significantly different from each other. In the ink-receptive layer, which mainly comprises a polymer as in Ali, high glossiness can be obtained but ink is absorbed while swelling the polymer so that an ink-absorption rate is slow and inferior. However, in the ink-receptive layer mainly comprising a pigment as in the presently claimed invention, high glossiness can be only be obtained with difficulty. However, ink can be rapidly absorbed by voids, so that a high ink-absorption rate can be obtained.

An object of the present invention is to obtain an ink-jet recording material having high glossiness wherein it includes an ink-receptive layer mainly comprising a pigment. Accordingly, in the presently claimed invention, among pigments, fumed silica having an ultrafine particle size of an average primary particle diameter of 20 nm or less is used. When a synthetic silica (precipitated silica) prepared by a wet process, which is a general synthetic silica, is used, high glossiness and high ink-absorption property cannot be obtained simultaneously.

In Ali, silica is used for the purpose of improving handling and flexibility (see column 19, lines 58-60 of the reference), but the amount thereof is limited, which means it takes an extremely small amount to result in a haze level 15% or less. This is a reverse technical thought to that of the present invention, which uses a large amount of silica, i.e., 8 g/m^2 or more to form a large number

of voids.

Also, in Ali, a large size silica having a diameter of 5 to 40 μm (i.e., 5 to 40 x 10^{-6} m) is used for the purpose of improving handling, which is also quite a reverse technical thought to that of the present invention, which uses fumed silica having an ultrafine particle size of an average primary particle diameter of 20 nm (i.e., 20 x 10^{-9} m) or less.

Moreover, in Ali, an ink-absorptive polymer is mainly used in the ink-receptive layer, which is fundamentally different in the constitution of the ink-receptive layer. Ali also teaches a mechanism of absorbing ink that is different from that of the presently claimed invention which mainly uses fumed silica in the ink-receptive layer to form voids and uses a hydrophilic binder in an amount of 50% by weight or less based on the amount of the fumed silica.

In addition, Ali significantly differs from the present invention in the object of using a water-soluble polyvalent metallic compound and an effect of the same. That is, in Ali, the compound is used for the purpose of cross-linking a cross-linkable matrix component and a chelate compound. On the other hand, in the presently claimed invention, the water-soluble polyvalent metallic compound is used to prevent surface cracks which is a specific problem for the fumed silica having an average primary particle diameter of 20 nm or less as well as to improve water fastness and light fastness.

Thus, while the presently claimed invention and Ali both use a water-soluble polyvalent metallic compound, there are many essential and fundamental differences in their components. Certainly, the Ali's object and effect of using the water-soluble polyvalent metallic compound are significantly different from each other. Thus, a person of ordinary skill in the art would not

be led to the presently claimed invention by referring to the teachings of Ali.

Accordingly, the presently claimed invention is no where disclosed, suggested or made obvious by the teachings of Ali et al. The presently claimed invention is fully allowable under Section 103(a) in view of Ali et al.

The presently claimed invention has been shown to clearly distinguish over the teachings of Ali et al. The teachings of Santo et al. do not remedy the deficiencies of Ali, nor do the teachings of Kasahara et al. remedy the deficiencies of Ali.

The presently claimed invention is fully allowable under Section 103(a) in view of the cited prior art.

In view of the above and the attached two technical publications, it is believed that this application is in condition for allowance and a Notice to that effect is respectfully requested.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Proposed Amendments To The Specification Showing Deletions And Insertions.

Page 1, Paragraph Starting At Line 24

There have been proposed recording sheets obtained by coating silica fine particles and a hydrophilic binder onto a paper support as disclosed in, for example, Japanese Provisional Patent Publications No. 51583/1980, No. 157/1981, No. 107879/1982, No. 107880/1982, No. 230787/1984, No. 160277/1987, No. 184879/1987, No. [183382//1987] 183382/1987, No. 11877/1989, and the like. These recording sheets are poor in water fastness, image quality and surface gloss since they comprise a combination of a pigment and a binder.

Page 5, Paragraph Starting At Line 4

The above objects of the present invention have been achieved by an ink-jet [printing] recording sheet which comprises a support and at least one ink-receptive layer provided on the support, wherein at least one of the ink-receptive layer contains silica fine particles having an average primary particle diameter of 20 nm or less and at least one water-soluble polyvalent metal compound.

IN THE CLAIMS:

Proposed Amendments To Claims 1, 2, 4, 7, 8, 9, 10, 11, 12, 14 15 and 16 Showing Deletions And Insertions.

Claim 1. (Twice Amended) An ink-jet [printing] recording sheet which comprises a water resistant support and at least one ink-receptive layer provided on the support, wherein at least one of the ink-receptive layer contains [synthetic] fumed silica fine particles [prepared by a gas phase process] having an average primary particle diameter of 20 nm or less in an amount of 8 g/m^2 or more, a hydrophilic binder in an amount of 50% by weight or less based on the amount of the fumed silica and at least one water-soluble polyvalent metal compound.

Claim 2. (Twice Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the water-soluble polyvalent metal compound is selected from the group consisting of a water-soluble aluminum compound and a water-soluble compound containing an element selected from the group consisting of titanium and zirconium.

Claim 4. (Twice Amended) The ink-jet [printing] recording sheet according to claim 2, wherein the water-soluble aluminum compound is polyaluminum hydroxychloride.

Claim 7. (Twice Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the average primary particle diameter of the [synthetic] fumed silica [by the gas phase process] is 20 nm or less and a specific surface area measured by the BET method is 200 m^2/g or more.

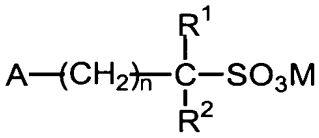
Claim 8. (Amended) The ink-jet [printing] recording sheet according to claim 7, wherein the ink-receptive layer contains the [synthetic] fumed silica in an amount of 10 g/m^2 or more and a hydrophilic binder in an amount of 10 to 30 % by weight based on the amount of the [synthetic] fumed silica.

Claim 9. (Amended) The ink-jet [printing] recording sheet according to claim 1, wherein a pH of a surface of the ink-receptive layer is 3 to 5.

Claim 10. (Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the ink-receptive layer contains polyvinyl alcohol as a hydrophilic binder and further contains a water-soluble plasticizer of the polyvinyl alcohol.

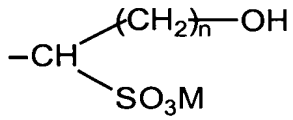
Claim 11. (Amended) The ink-jet [printing] recording sheet according to claim 10, wherein the water-soluble plasticizer is urea or glycerin.

Claim 12. (Twice Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the ink-receptive layer contains at least one compound selected from the group consisting of a nitrite, a sulfite, a bisulfite, a phosphite, a thiosulfate and a compound represented by the following formula (I):



(I

wherein A represents a hydroxyl group or an amino group which may be substituted by an unsubstituted or substituted alkyl group having 1 to 4 carbon atoms, or an unsubstituted or substituted aryl group; R^1 and R^2 are combined to form a 5- or 6-membered ring with the carbon atom to which they are bonded, or one of which represents a hydrogen atom and the other represents a hydrogen atom, an alkyl group having 1 to 17 carbon atoms, an aryl group which may be substituted by at least one of a hydroxyl group or $-SO_3M$, or a group represented by the following formula (II); n represents 0 or an integer of 1 to 8; and M represents a cation,



(II

where n and M have the same meaning as defined above.

Claim 14. (Twice Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the water resistant support is a polyolefin resin-coated paper.

Claim 15. (Amended) The ink-jet [printing] recording sheet according to claim 1, wherein the ink-receptive layer contains a hydrophilic binder and a cross-linking agent of the hydrophilic binder.

Claim 16. (Amended) The ink-jet [printing] recording sheet according to claim 15, wherein the cross-linking agent is boric acid or a borate.